

**SECOND FIVE-YEAR REVIEW REPORT
SEMET RESIDUE PONDS SUBSITE
ONONDAGA LAKE SITE
ONONDAGA COUNTY, NEW YORK**



Prepared by

**U.S. Environmental Protection Agency
Region 2
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LIST OF ABBREVIATIONS & ACRONYMS

BCA	Brushy Cleared Area
BERA	Baseline Ecological Risk Assessment
BUD	Beneficial Use Determination
cy	cubic yard
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FRP	Fiberglass Reinforced Plastic
FYR	Five-Year Review
FFS	Focused Feasibility Study
GWTP	Groundwater Treatment Plant
HHRA	Human Health Risk Assessment
ICs	Institutional Controls
ISS	In-Situ Solidification/Stabilization
IRM	Interim Remedial Measure
µg/kg	Micrograms per Kilogram
µg/L	microgram per liter
MNA	Monitored Natural Attenuation
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
OU	Operable Unit
POC	Point of Compliance
PRP	Potentially Responsible Party
RCRA	Resource Conservation and Recovery Act
RAO	Remedial Action Objectives
ROD	Record of Decision
RA	Remedial Action
RD	Remedial Design
RI	Remedial Investigation
RPM	Remedial Project Manager
SCOs	Soil Cleanup Objectives
SMP	Site Management Plan
SVOCs	Semi-volatile organic compounds
UU/UE	Unlimited Use/Unrestricted Exposure
VOCs	Volatile Organic Compounds
WMA	Waste Management Area
WQC	Water Quality Criterion
WASDS	Willis Avenue/Semet Drainage Swale

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act, Section 121, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

The Onondaga Lake Superfund site currently includes eleven subsites (subsites are defined as any site that is situated on Onondaga Lake's shores or tributaries that has contributed contamination to or threatens to contribute contamination to Onondaga Lake). Each subsite consists of one or more operable units (OUs). This FYR report evaluates the Semet Residue Ponds Subsite (Subsite) of the Onondaga Lake Superfund site.

This is the second FYR for the Subsite. The triggering action for this statutory review is the completion of the first FYR on September 24, 2015. The FYR has been prepared because hazardous substances, pollutants, or contaminants remain at the Subsite above levels that allow for unlimited use and unrestricted exposure (UU/UE).

This FYR was led by the EPA remedial project manager (RPM) and lead author, Thomas Mongelli. Participants included New York State Department of Environmental Conservation (NYSDEC) project manager Tracy Smith, EPA hydrogeologist Kathryn Flynn, EPA human health risk assessor, Michael Sivak, EPA ecological risk assessor Nicholas Mazziotta, and EPA community involvement coordinator Larisa Romanowski. The potential responsible party, Honeywell International Inc. (Honeywell), was notified of the initiation of the FYR. The review began on June 27, 2019.

The Subsite consists of two OUs. OU1 addresses the Semet residue material and impacted shallow and intermediate groundwater and OU2 addresses contaminated soil below and in proximity to the ponds, as well as Semet residue that was unable to be addressed as part of the OU1 remedy. The OU1 remedy has been implemented; the remedial action (RA) is currently underway for OU2. For purposes of consistency with Subsite documents, activities will be discussed in the context of OU1 and OU2. However, to support tracking in EPA's Superfund Enterprise Management System (SEMS), protectiveness determinations will be based on OU6 and OU27 of the Onondaga Lake Site for OU1 and OU2, respectively. Both OUs are the subject of this FYR.

Site Background

The approximately 40-acre, triangular-shaped Subsite is located in an industrial area along the southern shore of Onondaga Lake. It is bordered on the west and south by Crucible Industries,

LLC (Crucible), on the south by CSX railroad tracks and an industrial complex, on the north by Interstate Route 690 (I-690) and State Fair Boulevard, and on the east by the former Willis Avenue Facility. The Subsite included five irregularly-shaped former waste disposal ponds with an average depth of 9 feet in Pond 4 and between 2.5 to 4 feet in the other four ponds, covering a total of 11 acres, and a 13-acre Brushy Cleared Area (BCA), located northeast of the OU1 area. There were also two smaller ponds, known as the Stringer Ponds, located adjacent to the southwest side of Ponds 3 and 4. The Subsite location is shown on Figure A1, and a site plan is shown on Figure A2

From 1917 to 1970, the Semet-Solvay Division of Allied Chemical & Dye Company (predecessor to Honeywell) operated the Semet Residue Ponds as depositories for a tarry, organic-based residue generated by the acid washing of coke light oil during the production of benzene, toluene, naphthalene, xylene and “motor benzol” at its BTX (Benzol) Plant located immediately south of the railroad tracks that are on the southern border of the Subsite. Prior to that time, the area was used as a settling basin for the disposal of Solvay waste, known as Waste Bed A.

The ponds were constructed via drag line and bulldozer excavation into Waste Bed A. Dikes bordering the ponds were reportedly built from fill materials, including concrete rubble, old electrolytic cell parts, ashes, cinders, soil, Solvay Waste, bricks, stone, etc. In addition to the Solvay waste material, the area received coarse ash and cinders via conveyer buckets from stoker-fired boilers at the nearby Syracuse Works. A calcium carbonate-rich waste material, which originated from a former ammonium chloride operation, was also disposed of adjacent to Pond 2 prior to 1951. The surface of the ponds were approximately four inches thick and appeared as a weathered-black to brown granular material. Below the granular material was a highly viscous, black material that resembled tar.

Appendix A, attached, summarizes the documents utilized to prepare this FYR.

SEMET RESIDUE PONDS FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Semet Residue Ponds Subsite/Onondaga Lake		
EPA ID: NYD986913580		
Region: 2	State: NY	City/County: Town of Geddes, Onondaga County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	Has the site achieved construction completion? No	
REVIEW STATUS		
Lead agency: State <i>[If “Other Federal Agency”, enter Agency name]:</i>		

Author name (Federal or State Project Manager): Thomas Mongelli
Author affiliation: EPA
Review period: 6/27/2019 – 1/15/2020
Date of site inspection: 8/7/2019
Type of review: Statutory
Review number: 2
Triggering action date: 9/24/2015
Due date (five years after triggering action date): 9/24/2020

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

A remedial investigation (RI) to determine the nature and extent of contamination was conducted at the Subsite between 1989 and 1995 and included sampling of groundwater, surface water, sediments, soil, air, and waste material.

Fifteen Subsite-related organic compounds were detected in the groundwater. The volatile organic compounds (VOCs) detected include benzene, which ranged from 1 microgram per liter ($\mu\text{g/L}$) to 55,000 $\mu\text{g/L}$; toluene, which ranged from 0.6 $\mu\text{g/L}$ to 3,900 $\mu\text{g/L}$; xylene, which ranged from 0.6 $\mu\text{g/L}$ to 330 $\mu\text{g/L}$; and 2-butanone, which had concentrations that ranged from 16 $\mu\text{g/L}$ to 710 $\mu\text{g/L}$. The NYSDEC ambient water quality standards for Class GA groundwater for benzene, toluene, and xylene are 1.0 $\mu\text{g/L}$, 5.0 $\mu\text{g/L}$, and 5.0 $\mu\text{g/L}$, respectively. The NYSDEC ambient groundwater quality guidance value for 2-butanone is 50 $\mu\text{g/L}$. These compounds can be traced to the material deposited in the ponds or their breakdown products. Semi-volatile organic compounds (SVOCs) detected include phenol, 2-methylphenol, 4-methylphenol, and 2,4-dimethylphenol at concentrations ranging from 2 $\mu\text{g/L}$ to 10,000 $\mu\text{g/L}$ and naphthalene at concentrations ranging from 3 $\mu\text{g/L}$ to 1,100 $\mu\text{g/L}$. The NYSDEC ambient water quality standards for Class GA groundwater for total phenolic compounds is 1.0 $\mu\text{g/L}$ and the ambient water quality guidance values for naphthalene is 10 $\mu\text{g/L}$.

Surface water samples were collected in Onondaga Lake and Tributary 5A during the RI. The samples contained benzene at concentrations ranging from 87 to 110 $\mu\text{g/L}$ in Onondaga Lake and from 18 to 110 $\mu\text{g/L}$ in Tributary 5A. These values exceeded the NYSDEC ambient water quality standard of 10 $\mu\text{g/L}$ for human consumption of fish in Onondaga Lake's Class C waters. The reported groundwater benzene concentration of 55,000 $\mu\text{g/L}$ exceeded the NYSDEC 1998 Water Quality Criterion (WQC) for fish propagation protection of 210 $\mu\text{g/L}$. The reported toluene groundwater concentration of 3,900 $\mu\text{g/L}$ exceeded the WQC of 100 $\mu\text{g/L}$. The reported naphthalene groundwater concentration of 1,100 $\mu\text{g/L}$ exceeded the WQC of 13 $\mu\text{g/L}$.

The benzene concentration in lake sediment of 16,000 micrograms per kilogram ($\mu\text{g}/\text{kg}$) exceeded the NYSDEC human health bioaccumulation sediment criteria of 18.0 $\mu\text{g}/\text{kg}$. This benzene concentration also exceeded the benthic Class A, B, and C sediment guidance values of <530 $\mu\text{g}/\text{kg}$, 530-1,900 $\mu\text{g}/\text{kg}$, and >1,900 $\mu\text{g}/\text{kg}$, respectively.

The residues in the five ponds consisted of an organic phase and an acid phase. The organic phase was composed of more than 100 organic compounds, primarily, aromatic hydrocarbons, substituted aromatic hydrocarbons, alkanes, substituted alkanes, polyaromatic hydrocarbons, aldehydes, and ketones. Benzene, toluene, xylene, and naphthalene were found to comprise up to 10% of the organic phase of the pond residues. The acid phase of the pond residues was highly acidic, with a pH between 1 and 2.6. Based on 6 NYCRR Part 371, this phase was considered to be characteristic hazardous waste as defined by the Resource Conservation and Recovery Act due to its high acid content and a pH less than 2. Therefore, because of the significant toxicity posed by the high acid content and low pH, the residue in the five ponds was considered to be a principal threat.

As part of the RI process, a baseline risk assessment was conducted to estimate the risks to human health and the environment. The baseline risk assessment, consisting of a human health risk assessment (HHRA), which evaluated risks to people, and a baseline ecological risk assessment (BERA), which evaluated risks to the environment, analyzed the potential for adverse effects, both under current conditions at the time and if no actions were taken to control or reduce exposure to hazardous substances at the Subsite. Individual HHRA and BERAs were completed for OU1 and OU2 of the Subsite.

The primary exposure scenario that represented a potential risk to human health involved trespassers who directly contacted the pond residue. Direct contact with the Semet residue was identified as a primary acute hazard that would result in burns to the skin which could have severe and potentially fatal effects, due to its acid content (pH of 1 to 2.6). The likelihood of this exposure scenario was reduced prior to the remediation of the pond residue with the construction of a six-foot chain-link fence that limited access to the Subsite.

Due to its acid content, there was also a significant risk to wildlife should they come in contact with the pond residue. Based upon the use of forage plant uptake factors for benzene from the soil, the concentration of benzene present in the pond residue, and the consideration of a white-footed mouse as a receptor, it was determined that there was a potential ingestion risk to a terrestrial herbivore and higher species. It was also determined that there was a potential risk to vegetation present. In addition, as with human exposure, wildlife coming in direct contact with the pond residue would suffer burns, which could have severe, and potentially fatal effects.

Response Actions

A number of response actions were undertaken to eliminate the migration of waste material and contaminated groundwater from the Subsite.

In December 1994, an interim remedial measure (IRM) to cover Ponds 3 and 4 with a spray-applied, cement-mortar coating to mitigate the emission of organic vapors from the ponds was

initiated. The IRM was expanded in 1996 to cover the remaining ponds. Prior to completion of OU1 construction activities, the cover was reapplied to all five ponds on an annual basis, usually in August.

Between 1996 and 1999, the I-690 storm drain system was evaluated and rehabilitated to isolate contaminants from the Subsite and the adjacent Willis Avenue Chlorobenzene subsite from infiltrating into the storm sewer.

Another IRM was performed between September 2001 and June 2002 which included field investigation tasks (*i.e.*, site reconnaissance, soil sampling, subsurface borings, and test pits) to evaluate the presence and extent of Semet material seeps associated with the five ponds. A temporary cover was placed over the observed seeps to minimize direct contact exposure to humans and ecological receptors. Additionally, plastic and earthen material was placed over these areas annually to minimize odors.

In March 2002, a Record of Decision (ROD) was issued for OU1 of the Subsite. The selected remedy included excavation and reuse of the material present in the ponds, specifically for on-site processing for use in the production of a soft tar product (RT-12), covering the Semet residue seeps until the materials were remediated, installation of a groundwater collection trench to prevent groundwater discharges to Tributary 5A, installation of a watertight sheet pile wall, collection trench, and groundwater extraction wells to prevent groundwater discharges to Onondaga Lake, installation of a treatment facility to process wastewater and groundwater, and maintenance of the temporary covers and fencing to limit human and wildlife exposure to contaminated soils and residues until the remediation was completed. The remedy also called for long-term groundwater monitoring and the imposition of institutional controls (ICs) to restrict on-site groundwater use and prevent human exposure to contaminated soils and residues until the selected remedy is fully implemented.

The OU1 ROD established the following remedial action objectives (RAOs):

- Prevent direct contact (human and wildlife) with the pond residue;
- Reduce volatile emissions from the pond residue; and
- Eliminate, to the extent practicable, migration of groundwater to Onondaga Lake and Tributary 5A that does not attain applicable state and federal water quality criteria for Site-related constituents.

In March 2019, a ROD was issued for OU2 of the Subsite which includes soils surrounding and below the Semet Residue Ponds and in the BCA and any remaining Semet residue unable to be beneficially reused off-site. The selected remedy includes treatment of any remaining Semet residue via *in-situ* solidification/stabilization (ISS), installation of a geomembrane cap and 18 inches of clean soil/granular backfill over the former Semet residue areas, and installation of a one-foot thick soil cover over the BCA and Lakeshore Area. The remedy also calls for grading to support redevelopment of the Subsite, development of a Health and Safety Plan, development of a Community Air Monitoring Plan, development of a Site Management Plan (SMP), continued maintenance and monitoring of the Willis-Semet Berm Improvement IRM, and ICs to restrict land

use, groundwater use, and require that intrusive activities be conducted in accordance with the SMP.

The OU2 ROD established the following RAOs:

- Prevent, or reduce to the extent practicable, ingestion/direct contact with contaminated Solvay waste/soil/fill material to be protective under the current and reasonably anticipated future land uses;
- Prevent, or reduce to the extent practicable, inhalation of or exposure to contaminants volatilizing from contaminated Solvay waste/soil/fill material and groundwater, and unacceptable inhalation threat associated with soil vapor; and
- Prevent, or reduce to the extent practicable, the release of Subsite-related contaminants to groundwater, surface water and sediment that may cause unacceptable adverse effects on shallow and intermediate groundwater, surface water or sediment quality in Tributary 5A and Onondaga Lake.

Status of Implementation

Shallow and Intermediate Groundwater

Because of the presence of historical fill materials (*e.g.*, Solvay waste) deposited at the Subsite, it is not anticipated that groundwater standards will be achievable at the Subsite within a reasonable timeframe. Therefore, the area is being treated as part of a waste management area (WMA) with the groundwater point of compliance (POC) being the WMA boundary (*i.e.*, outside of the barrier wall installed as part of an IRM— see Figure 2). The material within the WMA includes Solvay waste comingled with hazardous substances that are COCs for the Subsite. The management of the waste within the WMA includes meeting Resource Conservation and Recovery Act (RCRA) municipal landfill capping requirements. In many areas, existing covers and/or Solvay waste/soil/fill material is expected to meet the 1×10^{-5} centimeter per second permeability rate required under the RCRA Subtitle D standards. Buildings and asphalt parking lots are expected to achieve and exceed the infiltration requirements. In areas where existing covers or Solvay waste/soil/fill material do not meet the standard, cover material will include materials needed to achieve the required infiltration rate requirements.

Given the comingling of the shallow and intermediate groundwater with that of the adjacent Willis Avenue Chlorobenzene subsite, shallow and intermediate groundwater beyond the WMA POC for these two subsites was addressed under the remedy for the Willis Avenue Chlorobenzene subsite (*i.e.*, monitored natural attenuation [MNA]). A ROD for this subsite was signed in September 2019.

RAOs to eliminate the migration of contaminated shallow and intermediate groundwater are described in the December 2008 NYSDEC-approved Remedial Design Report, Semet Residue Ponds Groundwater Remedial Alternative, as modified by correspondence dated August 31, 2009 and November 20, 2009. The major elements of this remedial design (RD) are:

- Construction of a shallow sand-filled groundwater collection trench with a slotted Fiberglass Reinforced Plastic (FRP) groundwater collection pipe;
- Construction of two groundwater pump stations designed to convey collected groundwater to the Willis Avenue Groundwater Treatment Plant (GWTP);
- Installation of an FRP pipe and Ductile Iron Pipe (DIP) force main;
- Excavation and relocation of Semet material from the Stringer Ponds;
- Excavation and relocation of material from within the Tributary 5A limits;
- Installation of an isolation layer and placement of material within the Tributary 5A limits;
- Culvert cleaning and inspection; and
- Site grading and restoration of the tributary banks and channel.

Remedial activities associated with the above-described RD began in May 2010.

The groundwater collection system includes a six-inch slotted FRP collection pipe buried in sand trenches under, or adjacent to, Tributary 5A. The trenches discharge to pump stations designed to pump collected groundwater to the Willis Avenue GWTP at an estimated flow rate of 40 gallons per minute.

An isolation layer was constructed over the groundwater collection trench and beneath the Tributary 5A stream bed with the primary objective to minimize the potential discharge of contaminated groundwater into the tributary and subsequently into Onondaga Lake. The layer also minimizes the potential for migration of contaminated sediments into Onondaga Lake and the potential for surface water to enter the collection trench. While Tributary 5A sediment contamination is being addressed as part of the Willis Avenue Chlorobenzene subsite to allow for the placement of this isolation layer, material was excavated from within the tributary limits and relocated on-site.

During the installation of the groundwater collection trench conveyance piping, Semet material located in the Stringer Ponds was excavated and relocated to Semet Residue Pond 2. The Stringer Ponds were located between the Semet Residue Ponds and Reach 1. Approximately 5,200 cubic yards (cy) of material were removed from the Stringer Ponds.

As part of the remedial activities, a 60-inch culvert between Reach 2 and Onondaga Lake and a 72-inch culvert connecting Reach 1 and Reach 2 were inspected. Sediment was removed from the 60-inch culvert using high pressure water from a jet truck commencing at the Reach 2 inlet and working toward Onondaga Lake. Cleaning of the 72-inch culvert was completed via manual excavation and hydraulic flushing. Sediment from both culverts was collected and relocated on-site. After removing sediment from the 72-inch culvert, it was observed that its deteriorated condition allowed for groundwater infiltration. As a result, the existing 72-inch corrugated metal pipe was replaced with a 72-inch centrifugally cast fiberglass polymer mortar pipe.

Site restoration included placement of a minimum of six inches of topsoil to achieve the final designed grade at the Subsite along with seeding with a seed mix indigenous to the area to minimize erosion. Fencing and asphalt surfaces disturbed during construction were replaced. Approximately 12,880 cy of material was excavated from within the Tributary 5A boundary, consolidated at the Willis Avenue staging area, graded into a single pile, and seeded. Erosion

control fencing was subsequently replaced with a wood chip control berm. Similarly, approximately 9,600 cy of non-tributary material was excavated during the construction of the pump stations and the 72-inch culvert replacement. These non-tributary wastes were consolidated at the Semet staging area, graded into a single pile, covered with six inches of topsoil, and seeded.

From August 2008 to October 2009, a 1,612-foot long sheetpile barrier wall and groundwater collection system was installed along the Lakeshore Area of the Subsite to eliminate the discharge of contaminated groundwater and non-aqueous phase liquid to Onondaga Lake. This system was completed as the first phase of a three-phase, 7,600-foot barrier wall system constructed along the southwest shore of Onondaga lake between 2006 and 2012.

In 2011 and 2012, construction activities were taken at the Willis Avenue/Semet Drainage Swale (WASDS) project to prevent the migration of contaminated shallow groundwater into Onondaga Lake. A 1,922-foot long groundwater collection trench was installed under the WASDS swale footprint parallel to State Fair Boulevard. The solid wall pipe conveys the collected groundwater to the Tributary 5A Reach 2 Pump Station where it is eventually treated by the Willis Avenue GWTP. Approximately 430 cy of material was removed from the WASDS Project Area to accommodate the installation of the groundwater collection system, including 280 cy's of material from the Semet portion of the WASDS.

Semet Pond Material

The 2002 ROD called for the excavation and on-site processing of Semet material into a driveway sealer known as RT-12. This portion of the selected remedy was largely based on a 1999 Petition for Beneficial Use Determination (BUD) that was approved by NYSDEC in January 2002. However, after the signing of the ROD, it became necessary to reevaluate remedial alternatives for the Semet residues due to a change in market conditions for RT-12. This reevaluation included a fuel recycling pilot study that was completed in 2005. The results of this study were documented in a March 2005 Synthetic Fuel Recycle Pilot Program report, a July 2006 Focused Feasibility Study (FFS), and a second BUD that was finalized in August 2006. The 2006 BUD proposed an on-site treatment process using a rotary distiller to separate the Semet residue into two products-- a liquid consisting largely of benzene, toluene and xylene to be used as a feed stock for benzene-derived products and a solid, called Semet heel, to be used as a commercial fuel product, with properties similar to that of coal.

In 2009, a volume verification investigation was conducted as a pre-RD activity to more accurately estimate the volume of Semet residue to allow proper sizing of remedial components. The volume verification investigation indicated less volume of Semet residue (approximately 21.1 million gallons) than initially estimated (between 50 and 80 million gallons), necessitating further volume refinement prior to implementation of RD/RA activities. A pre-design investigation was conducted in 2010 to further refine the estimated volume of Semet residue, which confirmed a lower volume than assumed in the 2006 FFS. An FFS amendment which reevaluated the remedial alternatives for the Semet residue concluded that two alternatives, on-site distillation for beneficial reuse and off-site thermal treatment/reuse, should be further evaluated prior to identifying an alternative remedial alternative. In October 2010, Honeywell proposed to perform treatability studies to reduce uncertainties in the implementation of two potential remedial alternatives.

A Semet Residue Characterization for Thermal Treatment Remedy Selection Treatability Study was conducted to provide a range of dewatered Semet residue samples to off-site thermal treatment facilities for evaluation, characterize a range of dewatered Semet residue samples for evaluation of on-site distillation for beneficial reuse, and identify target compounds for future air monitoring programs. Analytical data from samples collected in December 2010 indicated that Ponds 3 and 4 contain a higher fraction of light hydrocarbons than Ponds 1, 2 and 5. While the generic New York State Department of Health guideline for acceptable perimeter limits for total VOCs in air is 5 parts per million (ppm) via a photoionization detector, air monitoring data revealed that the primary (approximately 66%) VOC constituent was benzene, which has a short-term guideline of 0.4 ppm. Therefore, a project-specific VOC perimeter limit of 1.2 ppm was proposed for the Subsite and approved by NYSDEC for subsequent treatability studies.

A Demonstration Program was undertaken in 2014 to provide further refinement of treatment options for the Semet residue. Removal, direct loading, and shipment of Semet residue from Ponds 2 and 5 were performed from July 2014 to December 2014. Three thousand one hundred seventy-eight (3,178) tons of material (2,946 tons from Pond 2 and 232 tons from Pond 5) were shipped to Green America Recycling, LLC, located in Hannibal, Missouri. Up to five trailers per day was achieved due to a lack of free aqueous phase in these ponds. This change in the remedy was memorialized in a July 2017 Explanation of Significant Differences (ESD). Under the Demonstration Programs and ESD, more than 32,000 tons of Semet residue were excavated and sent off-site for thermal processing and beneficial reuse.

In 2017, another Demonstration Program began to determine the effectiveness of *in situ* treatment of the remaining Semet residue that is unable to be sent off-site for beneficial reuse. This targeted treatment program involved the addition of amendments, primarily Portland cement, to alter the physical characteristics of any remaining Semet residue to a granular form to decrease the mobility of the material. Targeted treatment areas are approximately 15 feet by 15 feet areas extending in rows across each pond. Upon encountering targeted material, amendments are added until a granular appearance and minimum 10 pounds per square inch of unconfined compressive strength are achieved. Targeted treatment has been completed in all of the former pond areas.

Institutional Controls Summary Table

Table 1: Summary of Planned and/or Implemented ICs for the Semet Residue Ponds Subsite

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Site Use	Yes	Yes	Sitewide	Restrict land use to commercial (including passive recreational) or industrial use	Declaration of Covenants and Restrictions & Environmental Easement, September 2021
Groundwater	Yes	Yes	Sitewide	Restrict the use of on-site groundwater	Declaration of Covenants and Restrictions &

					Environmental Easement, September 2021
Soils/fill material	Yes	Yes	Sitewide	Require intrusive activities be conducted in accordance with the Site Management Plan (SMP)	Declaration of Covenants and Restrictions & Environmental Easement, September 2021
Vapor Intrusion	Yes	Yes	Sitewide	Require vapor intrusion investigation and/or mitigation measures be conducted for future on-site structures, as appropriate, in accordance with the SMP	Declaration of Covenants and Restrictions & Environmental Easement, September 2021

Systems Operations/Operation & Maintenance

The Tributary 5A collection system consists of the automatic control of the wet well submersible pumps and the monitoring of the collection pipeline and force main. The pumps are operated based on the groundwater level within the wet wells as measured by a submersible level transducer. The pump stations are designed to operate at a constant level set below the invert of the Linear low-density polyethylene liner.

The Operations and Maintenance Plan called for weekly inspections focusing on preventative maintenance, groundwater collection system maintenance, pump station maintenance, and restored area maintenance. Some items included in these inspections are site security inspections, pump operation inspections, inspection and cleaning of observation ports, collection pipes, and force mains, cleaning of pumps and wet wells, mowing, reseeding, etc.

Maintenance of the site cover will include monitoring to determine if success criteria are met and to identify the need for corrective action(s), as warranted. Corrective actions for covers may consist of repair in areas of disturbance or reapplication of vegetation in areas of non-survivorship.

Site monitoring and verification includes evaluation of the collection trench for the presence of contaminated overburden groundwater discharged to Tributary 5A. To document an inward hydraulic gradient for groundwater control, groundwater elevations are measured at observation ports along Reach 1 and Reach 2. Monitoring also includes annual sampling of six sediment and surface water locations, as well as monitoring of vegetation and tributary channels. A co-located sediment and surface water sampling location was added in 2014 at the outfall of the 60-inch culvert connecting Reach 2 to Onondaga Lake. See Figure A3.

Evaluation of the overall vegetative establishment indicates that restoration efforts continue to be successful. Tributary 5A continues to meet the vegetative cover, invasive species, and shrub

survival performance standards identified in the Tributary 5A Groundwater Remedial Alternative Monitoring and Verification Plan of 85%, less than 5%, and 90%, respectively.

Performance verification of the lakeshore barrier wall includes weekly visual inspections of the system and monitoring of trench water levels by tracking piezometer water levels against Onondaga Lake elevation data. Though the system operational target is for collection trench levels to be lower than lake elevation, the primary hydraulic containment measure provided by the system is the sheet pile barrier wall. Figure A4 includes a depiction of the barrier wall and piezometer locations.

Potential impacts from climate change have been considered, and the performance of the remedies is currently not at risk due to the expected effects of climate change in the region and near the Subsite.

III. PROGRESS SINCE THE LAST REVIEW

The protectiveness determinations from the last FYR are summarized in Table 3, below.

Table 3: Protectiveness Determinations/Statements from the 2015 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Will be Protective	The remedy at OU1 is expected to be protective of human health and the environment upon completion. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks.

The previous FYR had one recommendation. The status of the recommendation is summarized in Table 4, below.

Table 4: Status of Recommendations from the 2015 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
1	After the signing of the 2002 ROD, it became necessary to re-evaluate remedial alternatives for the Semet residues due to a change in market conditions for the product that was to be created from the Semet residues. Treatability studies have been performed	The ongoing studies need to be completed, a technology selected in a decision document modification, and the technology implemented.	Completed	An ESD was signed in July 2017 which modified the selected remedy to include, among other things, excavation of the Semet residue and transport off-site to a RCRA permitted thermal processing facility for beneficial reuse. As of 2019, all of the Semet residue that could be used at the thermal processing	7/17/2017

	to assess various remedial technologies. The ongoing studies have not resulted in a change to the remedy and its implementation.			facility has been removed. Any remaining Semet residue will be addressed by the OU2 remedy.	
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IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On October 1, 2019, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at Superfund sites in New York, New Jersey, Puerto Rico and the U.S. Virgin Islands, including the Semet Residue Ponds subsite of the Onondaga Lake Superfund Site. The announcement can be found at the following web address: <https://www.epa.gov/aboutepa/fiscal-year-2020-five-year-reviews>

In addition to this notification, a notice of the commencement of the FYR was sent to local public officials. The notice was provided to the town of Geddes by email on September 18, 2019 with a request that the notice be posted in town hall and on the town webpage. In addition, on September 18, 2019, the notice was distributed via the NYSDEC’s Onondaga Lake News email listserv, which includes approximately 11,000 subscribers. The purpose of the public notice was to inform the community that the EPA would be conducting a FYR to ensure that the remedy implemented at the site remains protective of public health and the environment and is functioning as designed. In addition, the notice included contact information, including addresses and telephone numbers, for questions related to the FYR process for the site. No interviews were conducted for this FYR.

Once this FYR is completed, the results will be made available at the Site information repositories and the site website: www.epa.gov/superfund/onondaga-lake. The information repositories are maintained at the NYSDEC Region 7 Office, 615 Erie Boulevard West, Syracuse, New York; NYSDEC Central Office, 625 Broadway, Albany, New York; Onondaga County Public Library, Syracuse Branch at the Galleries, 447 South Salina Street, Syracuse, New York; Solvay Public Library, 615 Woods Road, Solvay, NY 13209; and Atlantic States Legal Foundation, 658 West Onondaga Street, Syracuse, New York. In addition, efforts will be made to reach out to local public officials to inform them of the results.

Data Review

Groundwater

The groundwater containment system has two components, the Tributary 5A groundwater collection system and the lakeshore barrier wall.

The performance verification criterion for the Tributary 5A groundwater collection system was originally that groundwater elevations in the collection trench would be maintained below the geomembrane liner. In 2018, the performance verification target was changed to the surface water elevation, although the operational target is still that groundwater elevations in the collection trench be maintained below the liner. This change is described in the draft 2018 annual report and was made after evaluating five years of data which showed the groundwater collection system is able to successfully operate and prevent groundwater discharge to surface water even on occasions when groundwater elevations were above the liner elevation. Reach 2 CO-1 groundwater elevations were higher than expected from January to May in 2017 and 2018, but groundwater elevation monitoring conducted since the last FYR has shown that the Tributary 5A collection system has generally met the performance criterion with the exception of system shutdowns or maintenance.

For the lakeshore barrier wall, the most recent annual performance verification and monitoring report for 2018 indicated that with the exception of some instances from January to June and again in December 2018 when levels read around or above the fluctuating lake elevation, piezometer water levels along the Semet portion of the wall generally remained below the lake elevation, which is the system's operational target. Trench water levels in this area remained below the top of the wall throughout the monitoring period, which is the primary hydraulic containment measure provided by the system. The system operated continuously in 2018, except for minor shutdowns associated with maintenance or repair activities.

Groundwater at the Subsite is affected by and commingled with the groundwater contamination emanating from the adjacent Willis Avenue Chlorobenzene subsite. The groundwater remedy for this Subsite and the Willis Avenue Chlorobenzene subsite includes the restoration of shallow/intermediate groundwater at the WMA's POC via MNA and is included in the ROD for Willis Avenue, which was signed in September 2019.

Surface Water

Over the past four years, VOCs were detected in each of the six monitoring locations in Tributary 5A. However, only benzene exceeded its NYSDEC Class C Surface Water Standards and Guidance Value (SGV) at location T5A-SW-19 in 2017. One SVOC, 3&4-methylphenol, was detected below its SGV at the mouth of Tributary 5A in Onondaga Lake in 2016. Another SVOC, bis(2-ethylhexyl)phthalate (BEHP), was detected above its SGV in 2015, 2016, and 2017. Because BEHP was not detected in upgradient samples, the source is likely storm water entering Tributary 5A through the I-690 drainage sewer. Various inorganic contaminants, including iron, aluminum, thallium, vanadium, and mercury all exceeded their SGVs over the past four years. While mercury is associated with the adjacent Willis Avenue subsite, it has been detected at lower concentrations in on-site soils. The remaining inorganic contaminants are not consistent with those associated with the Subsite and are likely originating from an off-site source. Additional investigations regarding off-site sources are being performed by NYSDEC.

Sediment

Soil brought on-site as part of the Tributary 5A RA was screened against NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives (SCOs). Therefore, these SCOs have been the appropriate screening values for the sediment samples collected over the past four years since new sediment in the tributary originating from the Subsite would not be expected to exceed these values.

VOCs were detected at all six sampling locations each year since the last FYR. In 2015, 2016, and 2017, acetone and 2-butanone exceeded their SCOs with maximum concentrations of 3,300 micrograms per kilogram ($\mu\text{g}/\text{kg}$) and 2,200 $\mu\text{g}/\text{kg}$, respectively, in 2017. In 2017 and 2018, benzene exceeded its SCO at one location with a maximum concentration of 450 $\mu\text{g}/\text{kg}$ in 2017, and in 2018, toluene exceeded its SCO at one location with a concentration of 7,800 $\mu\text{g}/\text{kg}$.

Multiple SVOCs were detected in sediment samples over the past four years with concentrations generally increasing while moving from upstream to downstream. In 2015, the SVOC with the highest detection was flouranthene at location T5A-SED-18 with a concentration of 5,400 $\mu\text{g}/\text{kg}$. In 2016, benzo(a)anthracene had the highest detection at the same location with a concentration of 2,200 $\mu\text{g}/\text{kg}$. In 2017, benzo(a)anthracene and benzo(b)fluoranthene both had concentrations of 1,500 $\mu\text{g}/\text{kg}$ at location T5A-SED-17, and in 2018, benzo(b)fluoranthene had the highest detection with a concentration of 1,800 $\mu\text{g}/\text{kg}$ at location T5A-SED-19.

Various inorganics, including barium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, selenium, and zinc were detected in sediment samples over the past four years, and all exceeded their respective SCO on at least one occasion, with the exception of iron. Similar to surface water, none of these inorganic contaminants are associated with the Subsite and are likely originating from an off-site source. Additional investigations regarding off-site sources are being performed by NYSDEC.

Site Inspection

An inspection of the Subsite was conducted on August 7, 2019. In attendance were Robert Nunes, Thomas Mongelli, and Nicholas Mazziotta of EPA, Donald Hesler, Tracy Smith, Reginald Parker, and Harry Warner of NYSDEC, Mark Sergott of the New York State Department of Health, Shane Blauvelt and Stephen Miller of Honeywell, and Alma Lowry, Addie Rosa, and Richelle Brown representing the Onondaga Nation.

Due to ongoing construction of the OU2 remedy, the Subsite was observed to be cleared of vegetation with the exception of the perimeter of the Subsite along Tributary 5A and State Fair Boulevard. Excavation of Semet residue from the ponds and solidification of any remaining residue not able to be used off-site for beneficial reuse was observed to be completed. Fill had been placed in each of the pond areas, although none had reached final grading and the outlines of the former ponds were still visible. Final surface grading had been completed in the BCA in preparation for a request to use the area as parking for the New York State Fair, scheduled to begin exactly two weeks from the date of the inspection. Temporary fencing separating the BCA from the pond area had not yet been placed on-site.

No visible defects were noted in the Tributary 5A liner. However, an oil sheen was observed near one of the Crucible outfalls in the northwest portion of Reach 2. Additionally, a tank truck parked on the Crucible property near Reach 1 was observed to have a hose extending down into Tributary 5A as if to release its contents into the tributary. Reginald Parker of NYSDEC agreed to follow up with Crucible to find out more information about the nature of the truck's contents and activities and was informed that the activities were part of upstream sampling required under Crucible's State Pollutant Discharge Elimination System permit.

V. TECHNICAL ASSESSMENT

QUESTION A: *Is the remedy functioning as intended by the decision documents?*

All implemented components of the OU1 and OU2 remedies are currently functioning as intended. Field activities related to the excavation of Semet residue materials are now complete, with over 32,000 tons of Semet material transported off-site for beneficial reuse. Targeted treatment of the remaining Semet material via ISS has been completed with all the treated areas having met the unconfined compressive strength objective of 10 pounds per square inch. The groundwater containment portion of the OU1 remedy has also been fully implemented and continues to function as intended. As noted in the "Data Review" section, above, while surface water and sediment samples in Tributary 5A were found to exceed their respective SGVs and SCOs, these exceedances are likely originating from off-site sources (*i.e.*, Crucible outfalls) and additional investigations regarding these off-site sources are being performed by NYSDEC. One exceedance for toluene in 2018 at the sediment sampling location nearest to Onondaga Lake did not appear to be related to upgradient concentrations and will be monitored in the future. This was the first exceedance of toluene in six years. Trench water levels associated with the Semet portion of the Lakeshore Hydraulic Containment System have been observed to generally remain below Onondaga Lake elevations or the top of the wall with only brief periods when levels are observed to be higher than the fluctuating lake elevation.

ICs are not yet in place at the Subsite, but are anticipated to be implemented in the near future. In the interim, engineering controls prevent exposure to site-related contaminants, including fencing around the perimeter of the Subsite. The OU2 remedy, once implemented, will also eliminate potential exposure to contaminated soils through the placement of a clean soil and/or paved surface cover.

QUESTION B: *Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?*

Human Health

There have been no changes in the physical conditions of the Site over the past five years that would change the protectiveness of the remedy. The human health risk assessment (HHRA) conducted for OU1 concluded that there was potential unacceptable risk for trespassers who directly contacted the pond residue, while the OU2 HHRA concluded there is a potential for

unacceptable risk to the indoor/outdoor industrial worker and to the construction worker exposed to chemicals in the surface Solvay waste/soil/fill material. The exposure assumptions and pathways assessed in the RODs for the two OUs followed the Risk Assessment Guidance for Superfund used by the Agency and remain valid. Although specific parameters may have changed since the time the risk assessment was completed, the process that was used remains valid. In addition, some of the toxicity values that were used in the HHRA have changed; however, the changes would not impact the remedial decision that was made for the Site.

The RAOs continue to remain valid and the selected remedies are protective of human health. The implementation of the OU1 remedy and the partial implementation of the OU2 remedy, have effectively interrupted potential exposures to trespassers, indoor/outdoor industrial workers and construction workers at the Site. Once established, the ICs provided in Section II Table 1 will continue to restrict site use and prevent exposure to any residual contamination that remains. Although groundwater beneath the Subsite is classified by New York State as "Class GA," indicating a potable source of drinking water, the groundwater is not currently being used as a drinking water source. The implementation of ICs that restrict the use of groundwater, discussed in Section II, will ensure that the groundwater will not be used as a potable water supply in the future.

Cleanup goals identified in the RODs for OU1 and OU2 remain valid.

Vapor Intrusion

The ROD for OU2 included a provision that future on-site buildings should be evaluated for the potential for vapor intrusion and that vapor intrusion sampling and/or installation of mitigation measures may be required. Therefore, this pathway is also sufficiently addressed by the remedy.

Ecological

A habitat-based ecological assessment was conducted in accordance with the ecological risk assessment practices at the time that the assessment was performed. The assessment identified the habitat cover types present, along with wildlife potentially inhabiting the area. The assessment noted that the physical effects from dermal exposure outweighed the exposure from incidental ingestion due to the extreme corrosiveness (pH <1) of the waste material. Further, ingestion of plant material was associated with an unacceptable risk to benzene. There may be limited vegetated areas present at the Subsite following the remedial action. However, benzene uptake by vegetation is not expected to be a concern because the former Somet ponds and adjacent areas that had high benzene levels present will be covered by a liner system and a minimum 18 inches clean fill. In other areas of the Subsite (e.g., BCA) benzene was not detected at concentrations that would present significant uptake concerns.

Although the values and methodologies used may have changed, the risk assessment remains valid. The majority of waste material has been removed from the Subsite. All remaining residue present within the ponds has been treated on-site via ISS and covered with a geomembrane cap and fill material. Grading to support redevelopment will ensure that 18 inches of backfill material is evenly distributed across the Subsite, thus prohibiting exposure to ecological receptors. Furthermore, the

Subsite has been cleared of vegetation which reduces the likelihood of wildlife activity in this area. Therefore, the remedy is protective of ecological receptors.

QUESTION C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

There is no new information that calls into question the protectiveness of the remedies.

VI. ISSUES/RECOMMENDATIONS

Table 5, below, presents the recommendations and follow-up actions for this FYR.

Table 5: Issues and Recommendations

Issues/Recommendations				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
None				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 6	Issue Category: Institutional Controls			
	Issue: The 2002 Semet OU1 ROD called for ICs to restrict on-site groundwater use and prevent human exposure to contaminated soils and residues until the pond residue components of the remedy are complete. These ICs are not yet in place.			
	Recommendation: An IC restricting groundwater use should be implemented at the Subsite.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	State	9/30/2021

VII. PROTECTIVENESS STATEMENT

Table 6, below, provides protectiveness statements.

Table 6: Protectiveness Statements

Protectiveness Statement(s)		
OU6	<i>Protectiveness Determination:</i> Short-term Protective	<i>Planned Addendum Completion Date:</i> N/A
<i>Protectiveness Statement:</i> The remedy at OU 6 is protective of human health and the environment in the short-term because remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks. For the remedy to be protective in the long term, ICs need to be established.		
Protectiveness Statement(s)		
OU27	<i>Protectiveness Determination:</i> Will be Protective	<i>Planned Addendum Completion Date:</i> N/A
<i>Protectiveness Statement:</i> The remedy at OU 27 is expected to be protective of human health and the environment upon completion. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks.		

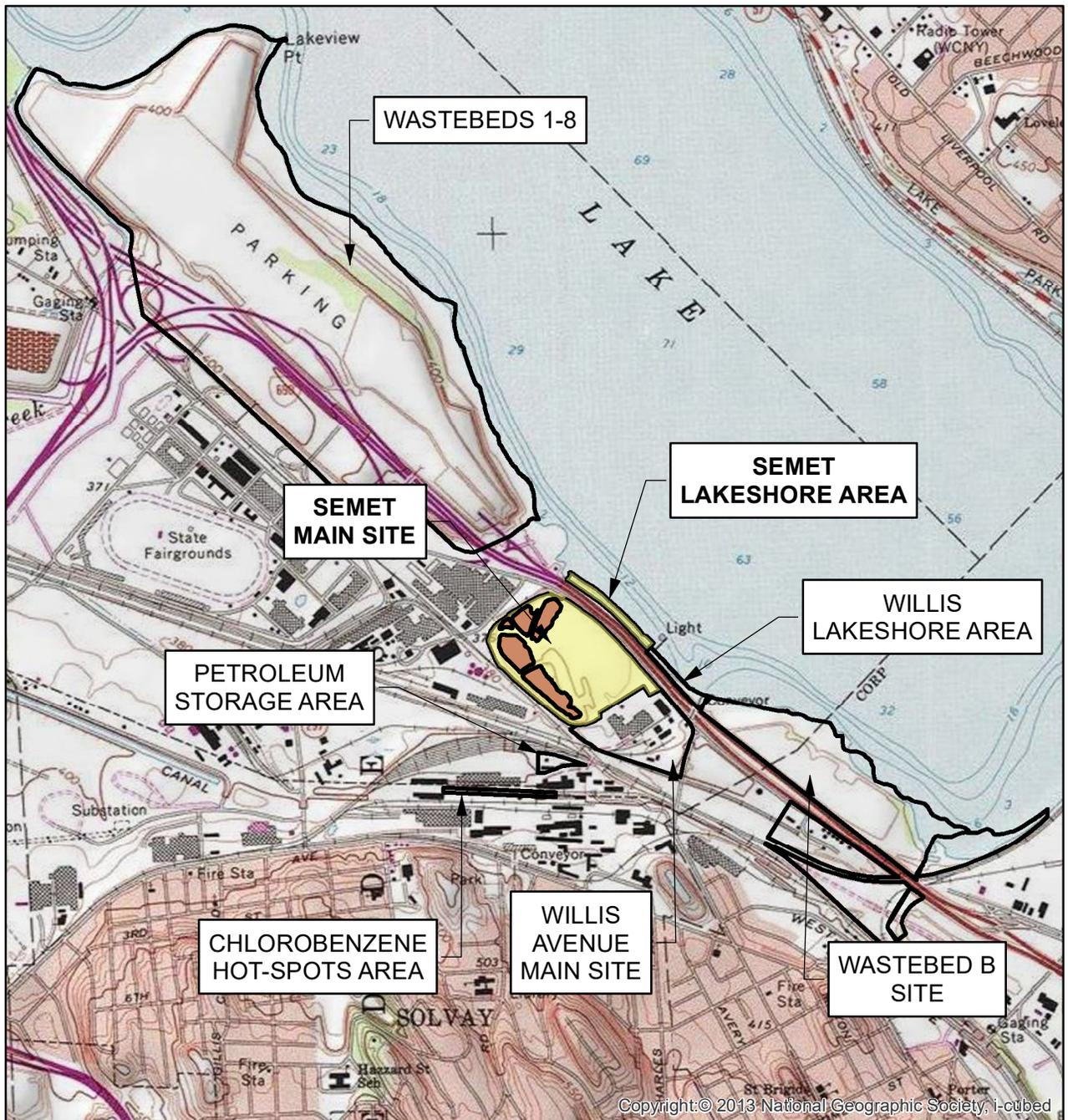
VIII. NEXT REVIEW

The next FYR report for the Subsite of the Onondaga Lake site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

- NYSDEC and EPA. 2002. *Record of Decision. Semet Residue Ponds Site. Sub-Site to the Onondaga Lake NPL Site*. March. NYSDEC and EPA. 2017. *Explanation of Significant Differences Semet Residue Ponds Subsite of the Onondaga Lake Superfund Site*. July.
- NYSDEC and EPA. 2019. *Record of Decision. Operable Unit 2 of the Semet Residue Ponds Subsite of the Onondaga Lake Superfund Site*. March.
- O'Brien & Gere. 1992. *Remedial Investigation Report, Semet Residue Ponds*. October 1991, Revised May 1992.
- O'Brien & Gere. 2016. *Honeywell Tributary 5A Groundwater Remedial Alternative 2015 Annual Report*. April.
- O'Brien & Gere. 2017. *Revised Semet Ponds Site Soil/Fill Material Ecological Risk Assessment (ERA)*. February.
- O'Brien & Gere. 2017. *Revised Semet Ponds Site Soil/Fill Material Human Health Risk Assessment (HHRA)*. March.
- O'Brien & Gere. 2017. *Honeywell Tributary 5A 2016 Annual Report*. March.
- O'Brien & Gere. 2018. *Tributary 5A Performance Verification 2017 Annual Report*. April.
- O'Brien & Gere. 2018. *Ballfield/Willis/Semet Berm and I-690 Underdrain Performance Verification 2017 Annual Report*. April.
- O'Brien & Gere. 2018. *Semet Residue Ponds Site OU-2 Final Data Summary Document*. June.
- O'Brien & Gere and Parsons. 2019. *Draft Honeywell Lakeshore Upland Sites, Performance Verification 2018 Annual Reports*. April.
- Parsons. 2018. *2017 Annual Performance Verification and Monitoring Report for Onondaga Lake, Attachment A*. April.
- Parsons. 2018. *2016 Annual Performance Verification and Monitoring Report for the Onondaga Lake Lakeshore Hydraulic Containment System*. May.

APPENDIX B – FIGURES



ADAPTED FROM: SYRACUSE WEST, NY USGS QUADRANGLE

HONEYWELL INTERNATIONAL INC.
 SEMET RESIDUE PONDS SITE
 GEDDES, NEW YORK



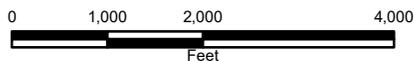
MAP LOCATION



SITE LOCATION

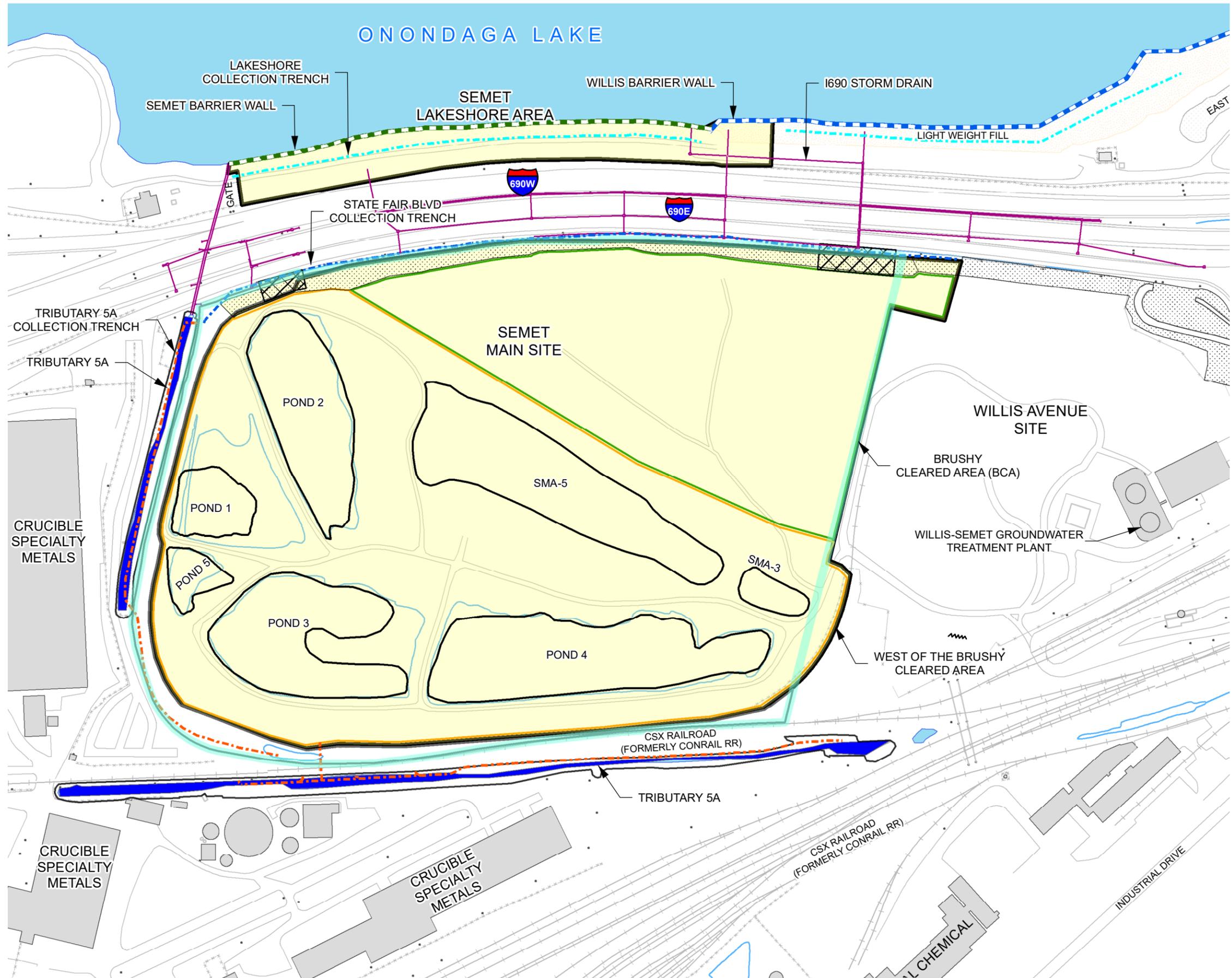
LEGEND

- SEMET RESIDUE PONDS
- SEMET RESIDUE PONDS SITE



1:24,000





LEGEND

- IRMS & REMEDIAL ACTIONS**
- STATE FAIR COLLECTION TRENCH
 - LAKESHORE COLLECTION TRENCH
 - TRIBUTARY 5A COLLECTION TRENCH
 - I-690 STORM DRAIN
 - SEMET BARRIER WALL
 - WILLIS BARRIER WALL
 - TRIBUTARY 5A
 - TRIBUTARY 5A SEDIMENT REMOVAL
 - SOIL REMOVAL AREA
 - BALLFIELD / WILLIS / SEMET BERM AREA
- STUDY AREA**
- SEMET RESIDUE PONDS SITE
 - WASTEBED A AREA
 - BRUSHY CLEARED AREA (BCA)
 - WEST OF THE BCA
 - SEMET BERM AREA

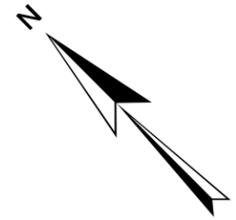
HONEYWELL INTERNATIONAL INC.
SEMET RESIDUE PONDS SITE
GEDDES, NEW YORK

SITE PLAN



FEBRUARY 2019
1163.63447



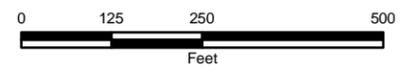


LEGEND

- CATCH BASIN
- ✦ SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS
- CRUCIBLE OUTFALL/CULVERT LOCATIONS
- TRIB-5A / I-690 STORM DRAINAGE SYSTEM

HONEYWELL
TRIBUTARY 5A
GEDDES, NEW YORK

SURFACE WATER AND
SEDIMENT MONITORING
LOCATIONS



1163.69551
MARCH 2019



O'BRIEN & GERE ENGINEERS, INC.

Service Layer Credits: USDA-FSA-APFO
Aerial Photography Field Office



LEGEND:

-  ONONDAGA LAKE
-  WALL
-  TRENCH
-  ACCESS ROAD
-  PIEZOMETER
-  SUMP
-  CLEAN OUT
-  COLLECTION SUMP
-  TEMPORARY COLLECTION TRENCH (NO LONGER IN SERVICE)
-  LIMIT OF LIGHTWEIGHT FILL



SCALE: 1"=200'

FIGURE A4

Honeywell ONONDAGA LAKE
SYRACUSE, NEW YORK

SEMET-WILLIS WALL AND COLLECTION
TRENCH LOCATION

PARSONS
301 PLAINFIELD ROAD, SUITE 350, LIVERPOOL, N.Y. 13212, PHONE: 315-451-9560